Exploratory Data Analysis

Lecture 1

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Technical University of Moldova

September 6, 2021

Outline

- Subject of Research & Methods
- Motivation
- Concepts and Definitions
- Practical Assignments in Python

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Lecture Outline

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Subject of Research

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Exploratory data analysis deals with methods of organizing, summarizing, and presenting data in a convenient and informative way to allow statistics practitioners present data in ways that make it easy for the reader to extract useful information.

Methods

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- Descriptive Statistics

  Descriptive Statistics are coefficients that summarize a given data set.

  - central tendency: mean, median, mode
  - variability: variance, standard deviation, range, kurtosis, skewness

- Graphical Techniques

  Graphical summaries are great tool to communicate information, because people prefer to look at pictures rather than at numbers.

  pie charts, bar graphs, histograms, box plots, dot plots, scatter plots

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Motivation (slide 1)

Why are descriptive statistics important?

In January 1986, the space shuttle Challenger broke apart shortly after liftoff. The accident was caused by a part that was not designed to fly at the unusually cold temperature of 29 F at launch.

Here are the launch-temperatures of the first 25 shuttle missions (in degrees F): 66, 70, 69, 80, 68, 67, 72, 70, 70, 57, 63, 70, 78, 67, 53, 67, 75, 70, 81, 76, 79, 75, 76, 58, 29.

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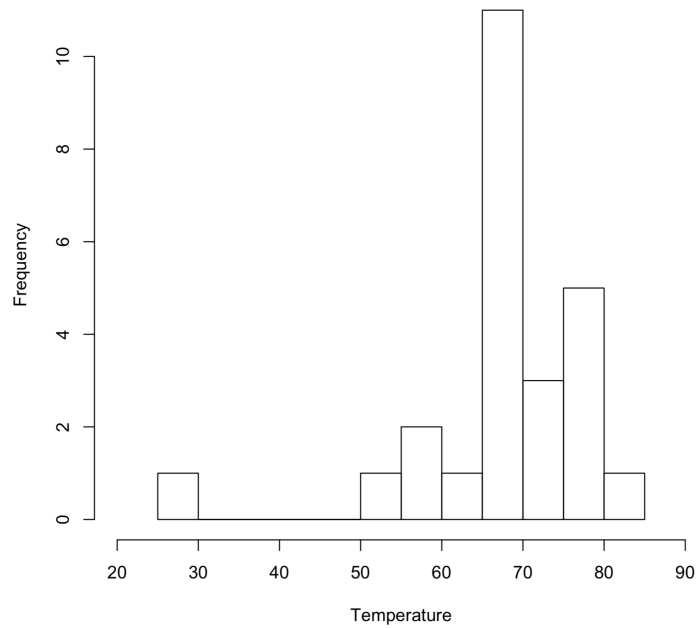

Motivation (slide 2)

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- Communicate information.
- Support reasoning about data.

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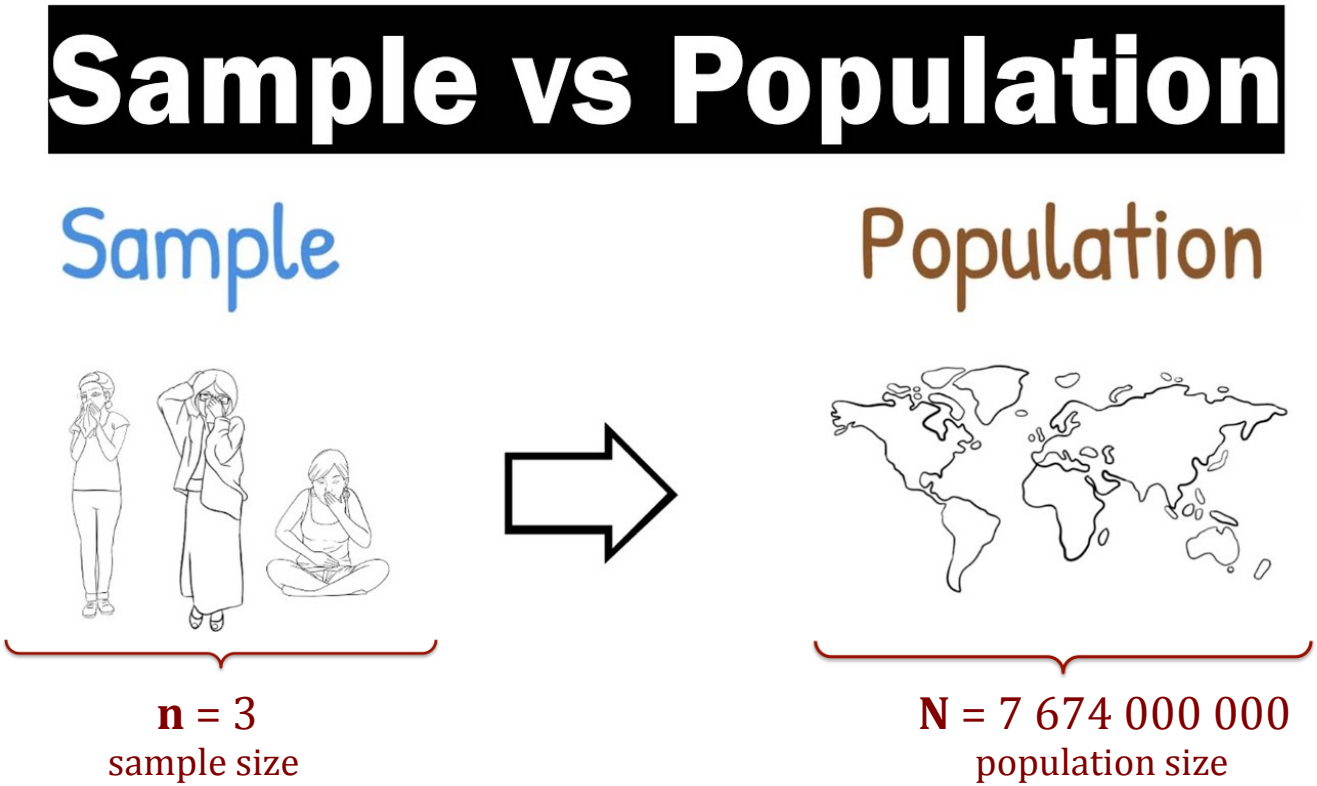
Sample and Population



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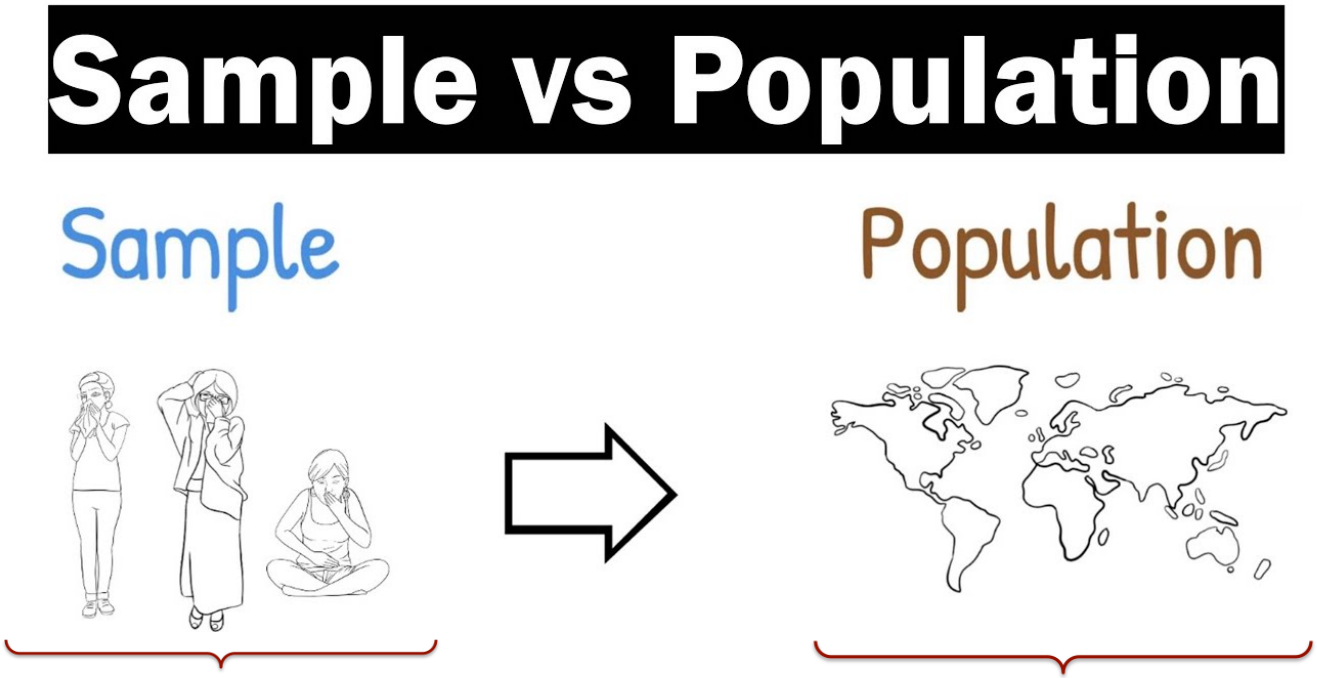
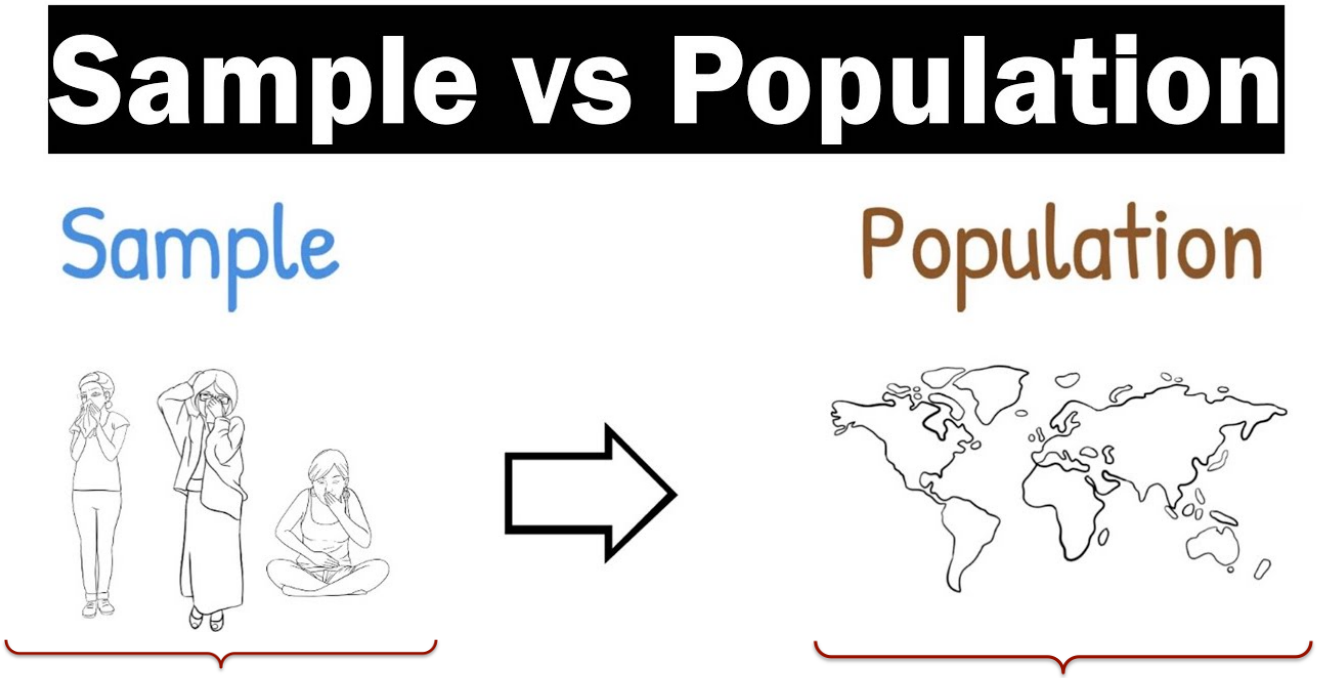


Population is a Relative Concept

People in R. Moldova **N** = 4 023 039

Sample and Population



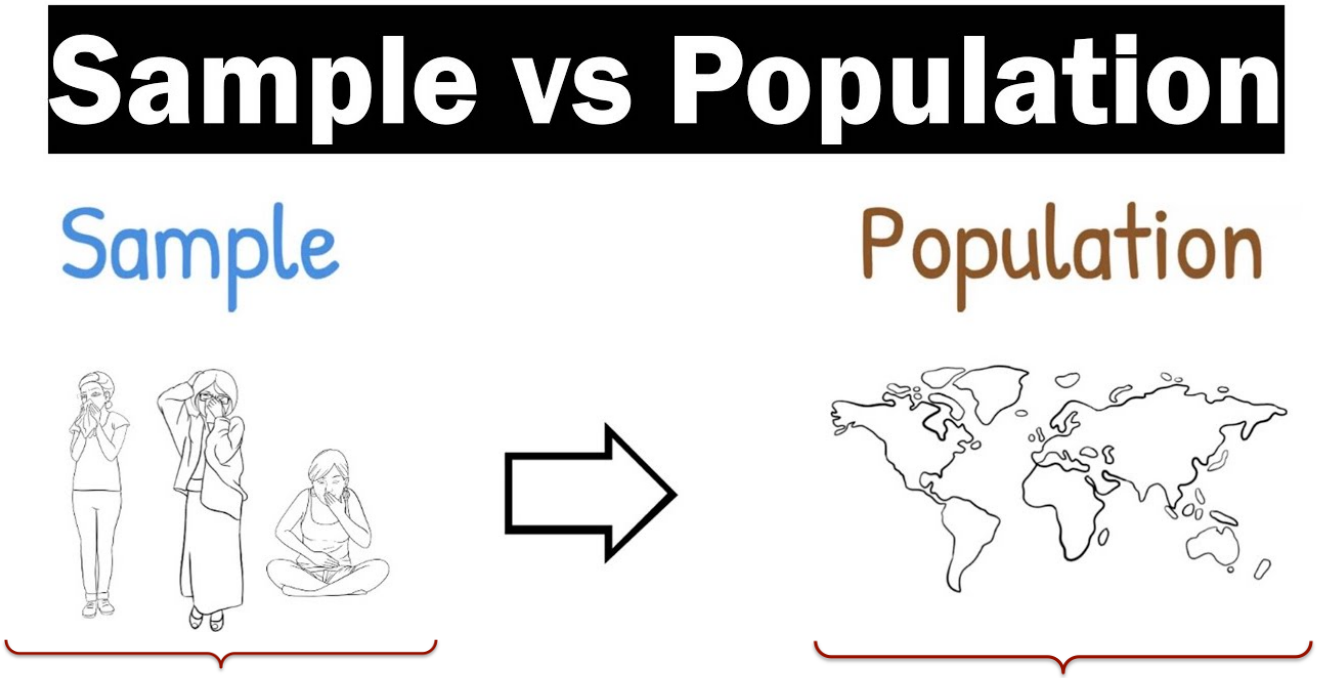
n = 3
sample size

N = 7 674 000 000
population size

Population is a Relative Concept

People in R. Moldova	**N** = 4 023 039
Pigs in the world	**N** = 677 600 000

Sample and Population



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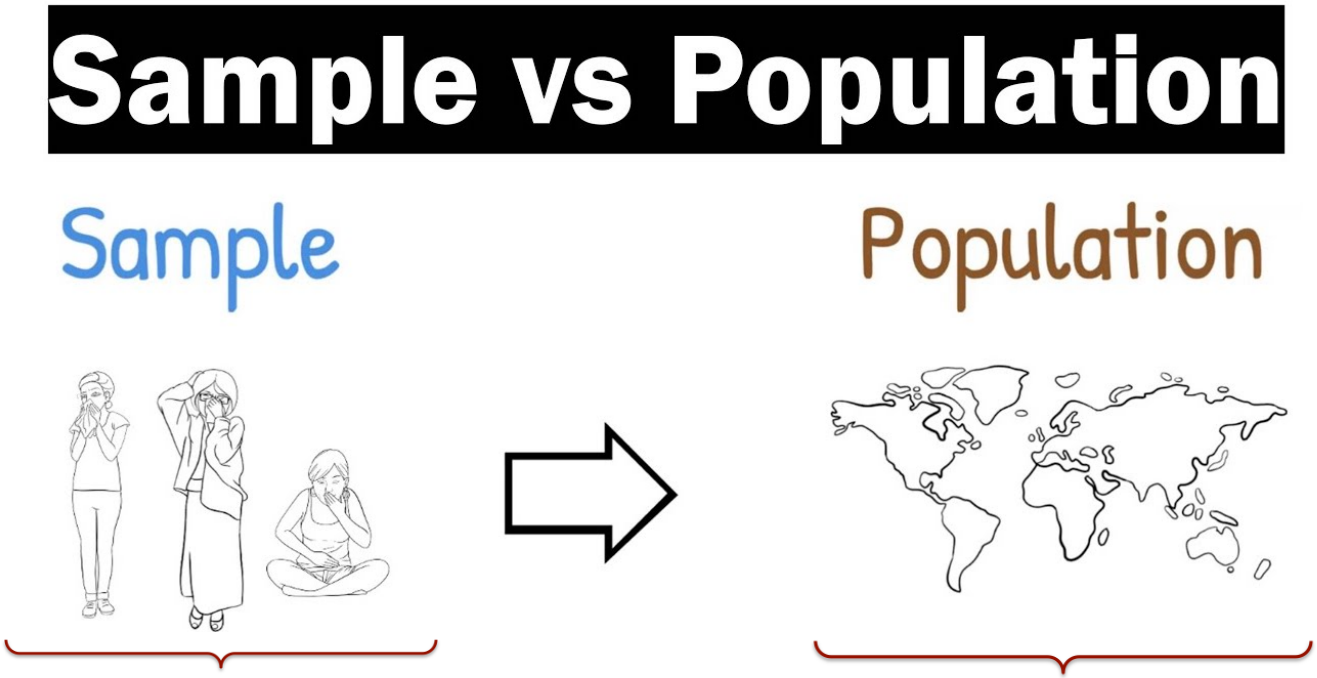

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Definitions

Population

In statistics, a population is the entire group that you want to draw conclusions about and from which statistical samples are drawn to be studied. It need not consist only of people. We can have population of heights, weights, BMIs, hemoglobin levels, events, outcomes, etc.

Sample

A sample is a subset containing the characteristics of a larger population that you will collect data from. Samples are used in statistical testing when population sizes are too large for the test to include all possible members or *observations*.

$$\mathbf{n < N}$$

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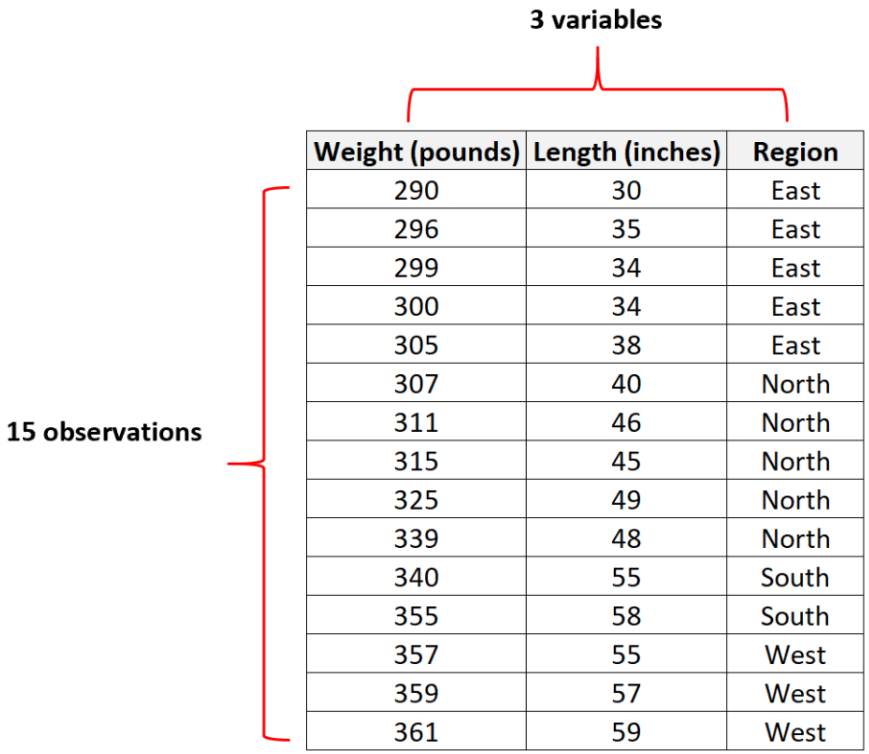

Weight (pounds)	Length (inches)	Region
290	30	East
296	35	East
299	34	East
300	34	East
305	38	East
307	40	North
311	46	North
315	45	North
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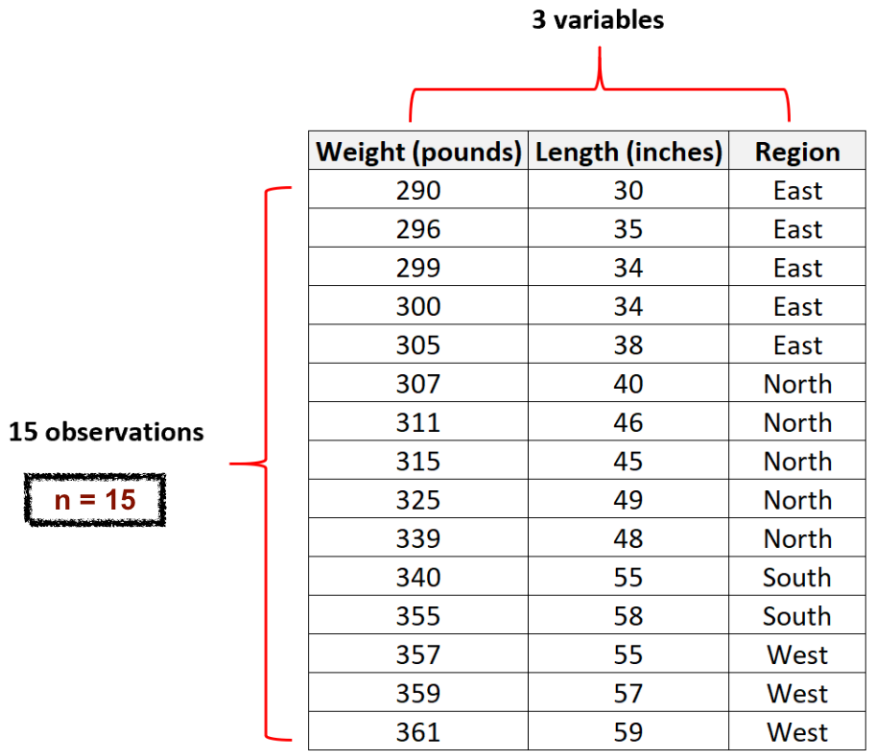

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Lecture Outline

The Mean

Mean

In statistics, the mean or the average is a measure of central tendency of a probability distribution. It is also referred to as an expected value.

- Population mean

$$\mu = \frac{\sum_{i=1}^{N} x_i}{N}$$

- Sample mean

$$\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n}$$

Mean Properties

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- Meaningful for interval and ratio data (continuous variables).
- Affected by unusually large or small observations (outliers).
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- The only measure of central tendency where the sum of the deviation of each value from the measure is zero, i.e.,

$$\sum(x_i - \bar{x}) = 0$$

Median Properties

Median

Median corresponds to the middle value when data are ordered from smallest to largest value (min to max). This results in an equal number of observations above the median as bellow it.

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Let's get Started!

Access Google Colaboratory

Create a Gmail account at: `https://accounts.google.com/signup`